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SSI:

Interim Report

Seals and Wild Salmon Fisheries

Sea Mammal Research Unit
Report to
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V5

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Executive Summary

This interim report documents findings from observational studies of seals at the Donmouth harbour seal haulout and provides an update on the ongoing analysis of seal observations from the River Dee, as well as other activities associated with the Seals and Salmon Interactions programme.

- The creation of a photographic identification file for each known Donmouth harbour seal has been completed.
- A preliminary assessment of images from the Dee has allowed the best images to be used to create identification files for seals photographed in the River Dee. Combining the Dee and Donmouth images, there are currently 40 identified harbour seals and 17 grey seals.
- Seal sighting rates from four locations within the River Dee are presented in this report. In Aberdeen Harbour, sightings rates were generally very high as seals were almost always present.
- Observations of seals predating salmonids were made in every month of the year with the exception of October. Observed predation rates peaked in February 2017 at an average of 0.6 fish per hour of observations for the harbour area.
- A preliminary investigation of the spatial distribution of seal sightings within Aberdeen Harbour is also presented.
- A small amount of effort-based observations were available for one site above the tidal limits.
- Data entry for seal sightings and behavioural observations has been completed for the entire study area. These data, when analysed together with the photo-id, will provide further insights into the interactions between seal species, their possible impacts on salmonids and the relationship between seals in the harbour and those travelling higher up the river.
- Seal images collected from further upriver suggest that two known harbour seals were regularly travelling upriver of the tidal limits during 2016/17. Although initial results suggest that a relatively large number of seals may utilise the harbour area of the river, only a small number of individuals may be impacting on angling interests further up the river. This suggests management action could be targeted at relatively few seals provided the turnover rate is low.

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1. Introduction

The current focus of the Seals and Salmon Interactions programme, funded by the Scottish Government through the Marine Mammal Scientific Support Research Programme 2015-2020, is on seal and salmon interactions within river fisheries. Seals may affect river fisheries directly and indirectly, both in relation to fish stocks and the economy of the local area. In recent times there has been a change in the approach to mitigating these effects, with a move away from non-selective management (e.g. shooting seals at nearby haul-outs), to progressively selective management and non-lethal measures. The main drivers for change have occurred as a result of significant declines in both predator (seals) and prey (salmonid) populations. Reductions in salmon stocks and catches have resulted in a need to resolve potentially deleterious effects of seals on salmon fisheries. Conservation Orders on many Scottish rivers now prevent the killing of salmon, while in other rivers catch and release policies serve to limit the killing of salmon by anglers. In 2016, 90% of the annual rod catch of salmon were released (Scottish Government, 2017).

Both grey and harbour seals are known to move up rivers and interact with river fisheries. The significant decline in local harbour seal populations on the east coast of Scotland (SCOS, 2016) has necessitated the development of non-lethal solutions for dealing with interactions between harbour seals and wild salmon fisheries.

Current objectives of the Seal and Salmon Interactions programme are:

- To investigate the number of seals using the River Dee and to provide an estimate of the number of salmonids consumed by seals in the river.
- To develop plans to catch and tag seals and to translocate problem seals.
- To produce a briefing paper on 'options to limit seal access to salmon rivers and non-lethal alternatives to limit depredation'.
- To provide support to District Salmon Fishery Boards (DSFBs) and wild salmon fishery stakeholders.

2. Study of seals in rivers

A project was set up in 2016 to collect 12 months of photo-identification and sightings data to record the occurrence of seals, and the frequency of prey capture events, in the River Dee. The DSFB had raised concerns over the frequency of seal (and dolphin) sightings in or near to the mouth of the river and the potential for these species to contribute to the decline in salmon numbers and catches in the river. The focus of the project during 2016/17 was the Aberdeen harbour area and a nearby harbour seal haulout site (Donmouth haulout). The DSFB were also concerned by the occurrence of seal sightings higher up the river, therefore additional observations to investigate the occurrence and behaviour of seals were carried out at other sites within the tidal reaches of the river. Incidental seal sightings, by fishers, from higher up the river were also recorded.

Observations of seals were carried out at the Donmouth haulout and from four locations within the tidal reaches of the River Dee (Figure 1). The Dee DSFB was also provided with a 300 mm camera lens to photograph any seals travelling above the tidal limits. The 12-month data collection period was successfully completed at the end of March 2017 with over 50,000 seal images collected from the Dee and Don.

The photographs and sightings provide information on the behaviour and distribution of seals in the River Dee over the course of a 12 month period. In particular, the sightings of seals with prey items provide individual diet information and a minimum estimate of the monthly rates of salmonid consumption by seals. Data are being used to provide an indication of the number of seals specializing in the consumption of salmonids in the River Dee and the number of seals foraging higher up the river.

The number of individuals and frequency of their incursions up the river provide information that will help in assessing the potential effectiveness of mitigation approaches, such as Acoustic Deterrent Devices (ADDs), hazing methods and relocation. Photo-identification data from the Donmouth haulout allows harbour seal haulout behaviour to be investigated. The haulout behaviour of individuals known to predate salmonids in the River Dee may offer opportunities to target these seals for capture on the haulout. Furthermore, images

collected from the haulout greatly improved image catalogues for harbour seals, increasing the partnering of left and right profiles and assigning sex to harbour seals.

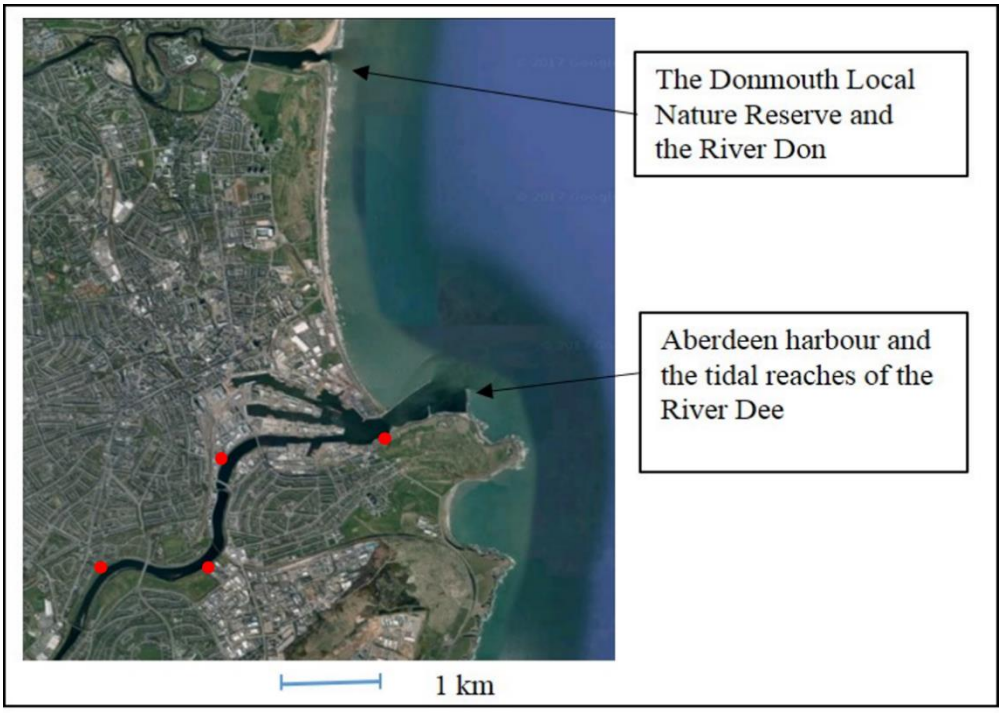

Figure 1. Map illustrating the proximity of the rivers Don and Dee, with red marks indicating the location of observation points on the River Dee, in order from the sea - Aberdeen Harbour, Victoria, Rail Bridge and the Fisher's Bothy.

2.1 Donmouth

The Donmouth Local Nature Reserve (LNR) is a beach site in the historic Old Aberdeen part of the city where the River Don meets the sea and includes 1.5 km of the lower river. The upper limit of the LNR is defined by the small Balgownie Bridge; a privately owned island within the LNR upriver of the Bridge of Don is used by harbour seals as a haulout site (Figure 2).

Figure 2. Aerial view of the Donmouth Local Nature Reserve (in blue) showing the privately owned island upriver of the Bridge of Don used by harbour seals as a haulout site (in red).

Three visits were made to the Donmouth LNR each month to photo-identify seals, with the exception of August 2016, when no photos were taken due to a heavy rain shower at the time of the visit. In addition, one extra visit was made during September 2016. Visits to the Donmouth LNR were made within two hours of low tide. The observer scanned the area with binoculars from the Bridge of Don to count seals on the island and to locate any seals in the water, both upriver and downriver of the bridge. Attempts were made to photo-identify any seals in the water, and seals on the haulout were photo-identified from the south bank of the River Don adjacent to the island. The observer remained on site for as long as it took to collect pelage photographs for each seal present. A 600 mm Canon lens with 1.4 tele-converter was used on a monopod with either a Canon 50D or 7D mark2 camera (www.Canon.co.uk), or 600 mm Minolta lens with Sony Alpha 700 camera (www.Sony.co.uk).

Seals were given a unique ID if sufficient pelage was visible on the head and neck to allow identification on future re-sightings. All images useful for identifying seals were stored to facilitate identification on subsequent visits and maximise opportunities for matches with seals in the River Dee. For each unique ID a selection of photographs were used to create an identification file with multiple orientations and postures to facilitate comparisons between haulout and river photographs. The collection of pelage images from the haulout was relatively simple compared with the collection of images from rivers, as mobile seals in an aquatic environment were more difficult to photograph than those at the haulout. Haulout-collected images therefore improved the ability to assign individual identities to images of seals collected in the Dee. Furthermore, viewing seals on the haulout allowed the sex of individuals to be assigned and improved evaluation of their age classes, as the relative size of each individual could be assessed by comparison with other individuals on the haulout.

This report primarily focuses on visits to the Donmouth haulout made over a 12-month period (April 2016 to March 2017). In total, 248 seal encounters (individual animals at the surface or hauled out and continuously visible) were recorded during 37 visits. Among these encounters, 219 included images that could enable an individual to be recognised from pelage patterns. The 29 remaining encounters were where individuals were not recognisable due to moulting, sand or mud coating the animals' pelage, poor angle or orientation of the photograph, or poor quality image. Furthermore, one trip was made to collect count data but no photo-identification data was collected due to heavy rain and time constraints at the time of the visit.

Thirty-seven unique seal identities were generated (35 harbour seals and two grey seals) from the 219 recognisable animal encounters. Of these, 31 harbour seal identifications included both left and right profiles of the seal, while three were left sided only and one was right sided only. This means there was a minimum of 34 harbour seal individuals present. A summary can be found in Table 1.

Table 1. Summary of harbour seal data collected over 12 months (April 2016 to March 2017) at the Donmouth LNR.

Trips	37
No. seal sightings	245 (plus 3 grey seals)
No. sightings identified	216 (plus 3 grey seals)
No. unique IDs	35 (plus 2 grey seals)
Unique IDs with both sides	31 (plus 2 grey seals)
No. left side only	3
No. right side only	1
No. females	14 (plus 1 grey seal)
No. males	10 (plus 1 grey seal)
No. unknown sex	11

The number of site visits per month at which each individual harbour seal was identified is provided in Table 2. The two harbour seals identified above the tidal reaches of the river Dee during additional observations in March 2017 (Section 2.2.4) are boxed in red. Although neither seal was identified on the haulout during December to February, a preliminary assessment of images from the River Dee revealed that both seals were regularly encountered foraging in the River Dee during these months. No seals were regularly identified hauling out within the Dee. The following points summarise the sightings histories for these two seals:

- Pv018D:- a young female harbour seal that was regularly sighted in the Don/Dee area throughout the year. She moulted early, primarily during July. Photographs on 10th August revealed an almost complete new coat. She never appeared pregnant and was never associated with a pup.
- Pv003D:- an adult male harbour seal blind in the left eye that was sighted regularly outside the summer months (May to August). This suggests that this seal may have used another area for breeding and moulting, before returning in September to the Rivers Don and Dee, where he was regularly sighted until the end of the reporting period.

Table 2. The number of resightings per month for each known harbour seal at the Donmouth LNR. Three visits to the haulout were made each month, so the maximum number of resights per month is three, with the exception of August (n=2 as no photos were taken during one August trip) and September (n=4 as one extra trip was made in September). Highlighted are two harbour seals identified above the River Dee's Normal Tidal Limit (NTL) during an additional series of observations in March 2017 (Section 2.2.4).

Seal	Age	Sex	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Pv003D	**Adult**	**Male**	**1**					**1**	**2**	**2**				**2**
Pv004D	Adult	Female	2								1			
Pv005D	Adult	Male	3		1		2	2	2	1		1	1	
Pv006D	Adult	?	3					1						2
Pv007D	Adult	Male	2	1	2	1	1	2	1					1
Pv008D_L	Juvenile	?	1											
Pv010D	Adult	Male	3											
Pv011D_R	Juvenile	?	1											
Pv012D	Adult	Female	2											
Pv013D_L	Juvenile	?	1											
Pv014D	Juvenile	Female	1			1	2	2				1	1	
Pv015D	Adult	Female	2			2	1	2						
Pv016D	Juvenile	Female	2										2	1
Pv017D	Adult	?	2				1	3	1				2	
Pv018D	**Juvenile**	**Female**	**3**	**1**	**2**	**2**	**1**	**2**	**1**	**2**				**3**
Pv019D	Adult	Male	2	1		2	2	3	1	2		1		2
Pv020D	Adult	Female	3			2	2	1	1	2		1	1	2
Pv021D	Juvenile	Female	2		1	1	2						1	
Pv022D	Adult	Male	3						1				1	1
Pv023D	Adult	?	1				1	1					1	
Pv024D	Juvenile	Female	2	1	1	3	1	1				2		
Pv025D	Adult	Female	1	1	2		2	2			1			
Pv026D	Juvenile	Female	1		1	1	2	2						
Pv027D	Juvenile	Female	2					1	1	1		1	1	
Pv028D	Juvenile	Male			1		1	2						
Pv029D	Adult	Male							1				1	
Pv030D	Adult	Male	2	1	1	1	2	2	1				1	1
Pv031D_L	Adult	?	1											
Pv032D	Pup/yearling	?											1	1
Pv033D	Juvenile	?												3
Pv035D	Adult	Female						1		1			1	
Pv038D	Juvenile	?						1	1					
Pv039D	Pup	Female				2		1	1	1				
Pv040D	Adult	Male					2	2						
Pv041D	Yearling	?												1

There were two peaks in seal numbers at the Don haulout: one in late spring (April) and another in late summer (August and September) (Figure 3). The latter peak coincided with the harbour seal moult. The lowest number of seals was recorded during May and in winter (December and January). It is not unusual for low counts to be recorded at harbour seal haulouts during the winter as seals often spend a greater amount of time in the water at this time of year (Russell *et al.,* 2015). The low numbers recorded in May and also at times in June suggest that the haulout is not used as a breeding colony, with harbour seals probably leaving the area to travel to breeding colonies. This observation is supported by the matching of a seal identified at the Donmouth haulout during the study with one identified at an Orkney breeding colony in both 2016 and again in 2017 (M. Arso pers. comm.). This male harbour seal was a regular user of the Donmouth haulout during April 2016 before travelling to Orkney, and was also regularly seen in Aberdeen Harbour during the winter of 2016/17, before returning to Orkney again in summer 2017.

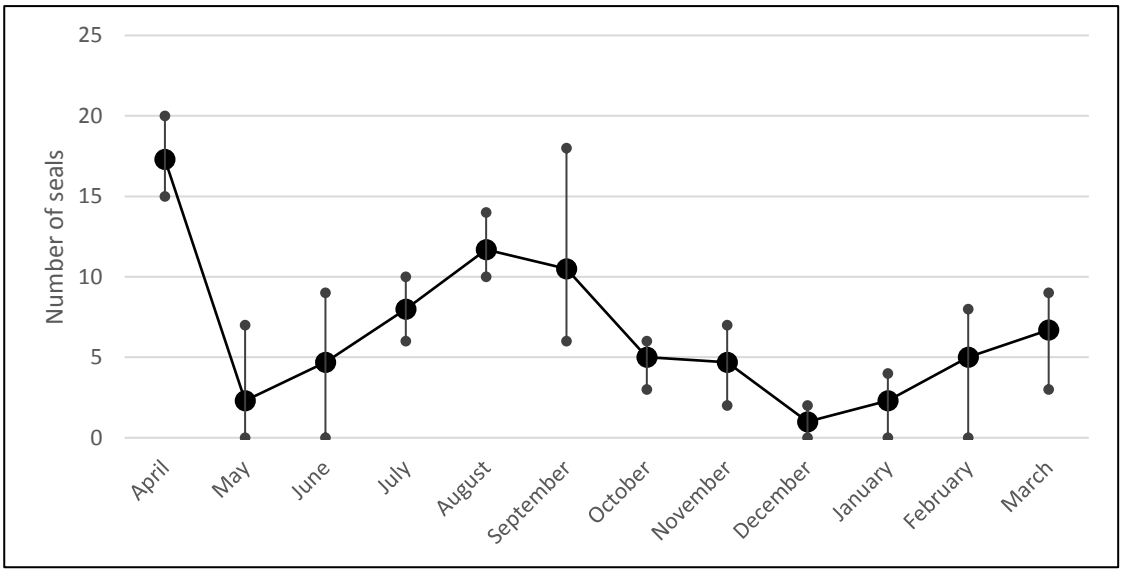

Figure 3. Monthly average count of seals at the Donmouth LNR, with maximum and minimum counts indicated by the smaller circles above and below the average value. Records run from April, 2016, through till March, 2017 (includes 2 grey seal sightings in September and 1 grey seal in November).

No information is available on where pregnant females from the Donmouth haulout gave birth.

Although it can be difficult to differentiate between adults and larger juvenile seals, each seal was given an approximate age class based on the experience of the first author (Table 3). These data suggested that at least six adult females used the Donmouth LNR, while a further four adults were of unknown sex. One potentially pregnant female was regularly sighted until 22nd June 2016, but was never seen with a pup. The other females recorded as adults were not seen in the area immediately prior to or during the breeding season (May and June), suggesting they may have used another area for breeding. One mother-pup pair was identified at the Donmouth haulout on 27th July 2016, and a further two yearling harbour seals were identified during the winter. One known adult female aborted a foetus in February 2017 (Figure 4).

Table 3. Age and sex classifications of known harbour seals from Donmouth haulout.

	Female	Male	Unknown
Adult	6	9	4
Juvenile	7	1	5
Pup/yearling	1	0	2

Figure 4. Photograph of female (Pv035D) with aborted foetus in its amniotic sac and placenta, 27th February 2017.

A harbour seal match was also made between the Donmouth LNR and a known river specialist seal first identified in the River Ness in 2005. This female seal was also sighted several times in the lower reaches of the River Dee predating salmon. Matches between the Aberdeenshire area, the Moray Firth and Orkney represent movement of harbour seals between three east coast management zones, Orkney and North Coast, Moray Firth and the East coast area.

Two different grey seals were photographed at the haulout. An adult female grey seal was seen hauled out on two dates in September and a known male grey seal regularly sighted in the Aberdeen harbour area of the River Dee was also identified in the River Don, next to the harbour seal haulout in November (Figure 5). The male grey seal had sustained substantial injures over a six month period while using the Aberdeenshire area, which may have been a result of intra-specific aggression over access to food in the Dee.

Figure 5. Images of female harbour seal (Pv018D) and male grey seal (Hg006D) - showing distinctive wounds on both left and right profiles used for individual identification.

The capture histories and identification files for individual seals from the Donmouth LNR have yet to be fully compared with all images from the River Dee. Matching river specialist seals to the Donmouth haulout will provide opportunities to target known seals for capture and tagging at the haulout. However, the low numbers of harbour seals at the Donmouth haulout in winter may require seals to be targeted for capture in the River Dee at these times, if they cannot be found at the haulout. Captured seals would be tagged to allow their movements in relation to salmon fisheries to be investigated and potentially to allow alternative non-lethal mitigation approaches to be investigated, such as relocation or targeted hazing if behavioural patterns can be ascertained.

2.2 River Dee

The River Dee flows through Aberdeenshire and is approximately 130 km in length from its upland reaches. It has been designated as a Special Area of Conservation (SAC) primarily for Atlantic salmon, otters and freshwater pearl mussels. Seals are known to predate salmon in the river disrupting fisheries, often sighted

more than 35 km up the river. The Dee DSFB receives regular reports of seals in the river and are therefore concerned about their impact on salmonid stocks, particularly at the river mouth and within its tidal reaches. The tidal reach extends approximately 5.5 km up the river, with the upper boundary defined by the Normal Tidal Limit (NTL). Seals that travel higher up river than the tidal limit disrupt an increasing number of beats which can result in fishers refusing to return to fish in areas that are visited by seals. Reports of seals above the NTL are collated by the DSFB; in 2014 there were 15 such reports. One of these included a photograph with sufficient resolution to distinguish the seal pelage pattern (Figure 6, Pv001D).

Figure 6. Harbour seal Pv001D photographed above the NTL in the River Dee, February 2014.

In 2015, river staff were able to photo-identify four out of 20 seal reports above the NTL. Harbour seal Pv002D was identified on two occasions, and harbour seal Pv003D on two occasions. A preliminary investigation of all photographs from the River Dee and Donmouth suggest that both Pv001D and Pv002D were not identified again following these initial photographs in the River Dee.

Reports of grey seals above the NTL were also received, with three reported in January 2016 (Table 4). One grey seal was shot in January 2016 but not recovered at the time of shooting. Another of the seals sighted in January was also shot at, however, the marksmen reported a miss. The recovery of a carcass of a male grey seal in the river in advanced stages of decomposition in April, was assumed to be the seal reported shot in January. Due to the level of decomposition no samples were collected. No further grey seal reports above the NTL have been noted since January 2016. However, species identification is not always easy and several reports each year are recorded as 'species unidentified' (Table 4).

Table 4. The number of reports of seal sightings above the NTL provided to SMRU by the DSFB.

	2014	**2015**	**2016**
Harbour seal	6	13	3
Grey seal	5	0	3
Unidentified	4	7	3
Total	**15**	**20**	**9**

Seal records prior to April 2016 predate the study being reported here.

Observations by SMRU observers were carried out between April 2016 and March 2017 within the tidal reaches of the river at four observation positions (Figure 1). A total of 670 hours of observations were carried out. This resulted in a total of 7822 seal sightings, with associated location and time recorded, and approximately 36000[1] seal images from within the tidal reaches of the River Dee were stored (Table 5). The

[1] These images consist of those captured by SMRU observers for the tidal reaches of the Dee only

logging of these sightings data by month into spreadsheets, along with 123 prey capture events and seal behavioural information, has been completed.

The initial focus within the tidal reaches of the River Dee was the harbour area. An observation protocol was established during April and May 2016, as well as an estimate of the number of hours required each month to allow salmonid consumption estimates to be generated. Following this, observations were included at other sites as effort/time allowed and it was acknowledged that it would be important to gather information from different tidal states each month. The Fisher's Bothy site was given highest priority after the harbour site and, when resources allowed, there was an attempt to fill in between these sites with observations at Victoria and Rail Bridge positions (Figure 1). Observations from these sites allowed for the majority of the River Dee tidal waters to be covered. Observations were spread across the tidal window to gather information from each stage of the tide every month. However, at Victoria, Rail Bridge and Fisher's Bothy sites where less observational effort was achieved, this was not always possible. Furthermore, during April 2016 which was the first month of the study, harbour observations were made from a variety of locations to determine which were most suitable for observational and photographic studies. As a result, sightings rates may be lower than expected for this month as all observations were included in this preliminary investigation and those at less optimal locations may have produced lower sightings rates.

Prey items were mainly identified as salmonids although flatfish, eels, sea bass and unidentified items were also recorded. The processing of images is continuing from the Aberdeen Harbour, while processing of images from Victoria, Rail Bridge, Fisher's Bothy (Table 5) and the Donmouth (Section 2.1) has been completed.

Table 5. The number of observation periods, number of hours of observations for seals (effort) and the number of seal sightings, photos and prey events recorded at four observation positions within the tidal reaches of the River Dee.

	Observation periods	Effort (hours)	No. sightings	No. photos	Prey events
Harbour	75	337	7381	34000	108
Victoria	15	63	126	564	6
Rail bridge	10	37	17	128	1
Bothy	53	233	298	1418	8
Totals	153	670	7822	36110	123

Image processing should be completed before March 2018 and will be reported on more fully at that time. However, a preliminary assessment of all the images has been carried out, with the better quality images for each seal encounter extracted and identification files for each putative individual created. The creation of these identification files has resulted in 17 different grey seal files and three more harbour seals that had not previously been identified at the Donmouth harbour seal haulout (Table 2). Two further files have been created for the two harbour seals, Pv001D and Pv002D, identified by the DSFB in 2014 and 2015, resulting in a total of 40 harbour seal files combined for the Don and Dee. A few grey seal files represent animals with poorly identifiable marks and it is hoped that these files will be consolidated or matched with others as image processing continues.

2.2.1 Aberdeen Harbour

Aberdeen harbour is one of the busiest ports in Britain and is the main commercial port in north-east Scotland, primarily serving the oil and renewables industries as well as RO-RO vessels (www.aberdeen-harbour.co.uk). The area around the harbour's breakwaters forms the entrance to both the harbour and the River Dee and is a foraging area for bottlenose dolphins, prompting the harbour trust to produce a dolphin code for mariners. This large harbour is broadly split into three fingers or docks (Figure 1), with the southern finger forming the river channel as it flows towards the breakwaters. Water depth within the harbour ranges between 9 and 14 metres.

Seals and Salmon Interactions

Seal observations were carried out from a fixed location overlooking the harbour. The vantage point allowed a view into each of the harbours' three fingers and also out towards the northern breakwater (Figure 7). Only the areas around the southern breakwaters and the distant reaches of the northern docks were not visible from the observation point. Regardless of the observation site chosen, docked or manoeuvring ships could obscure the view of observers for short periods of time. Seal sightings were photographed to identify individuals, feeding events to identify prey species and for distant seals to help assign species where possible. Each sighting was recorded with a time and location along with any behavioural information. Locations were assigned to one of seven zones within the harbour, the main river channel formed six of these zones with the two northern fingers forming the seventh zone (Figure 7).

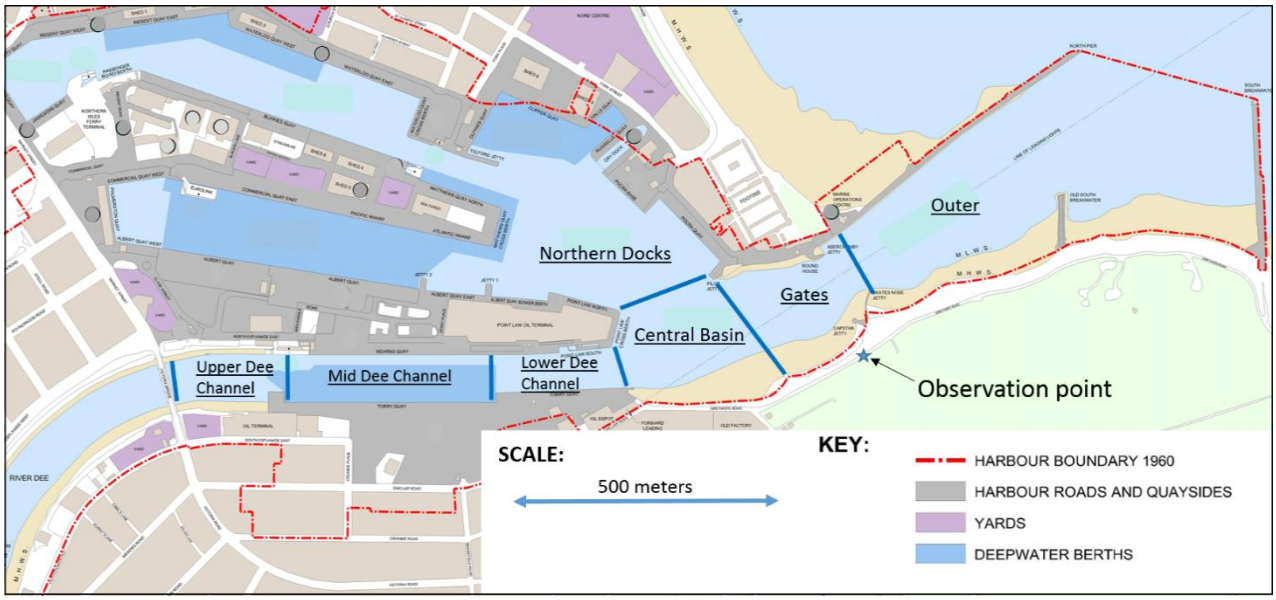

Figure 7. Aberdeen harbour showing the location of the observation point and the seven zones derived for the purpose of recording seal sightings (base map taken from www.aberdeen-harbour.co.uk)

Photo-identification images collected from Aberdeen harbour represent the largest set of seal images from the River Dee and Donmouth sites. A preliminary assessment of data from the harbour revealed that a large proportion of sightings each month, especially from May to November, were from the three Dee Channel zones (the Upper Dee Channel (UDC), Mid Dee Channel (MDC) and Lower Dee Channel (LDC)) (Figure 8). However, the high proportion of sightings in the narrowing of the harbour's entrance (Gates) during the late winter and spring suggests that seals may make greater use of this area during December to May before shifting further up the river's channel during the other half of the year (June to November).

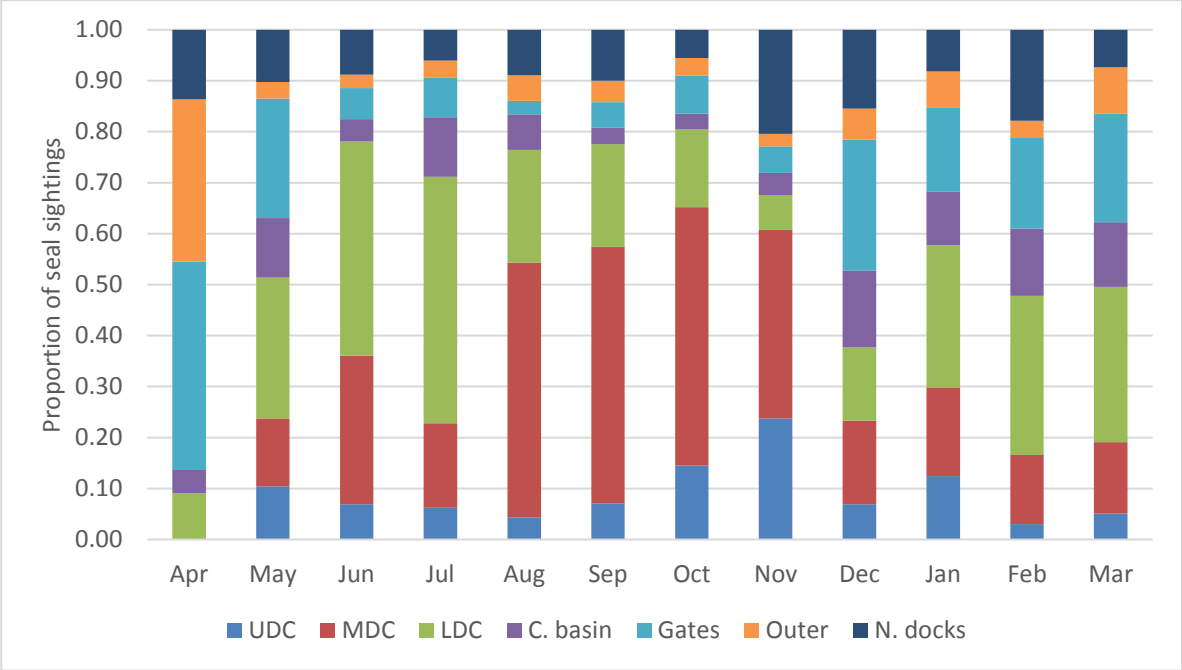

Figure 8. Distribution of seal sightings as a proportion each month across the seven harbour zones; Upper Dee Channel, Mid Dee Channel, Lower Dee Channel, Central Basin, Gates, Outer, and Northern Docks.

Seal sightings rates increased through the year from April to December, although the period of observer learning associated with April makes it uncertain whether the low sightings rate observed in April are biased. The highest seal sighting rates were in the winter, and salmonid predation events were also highest at this time, with another peak in observed salmonid predation events in June (Figure 9).

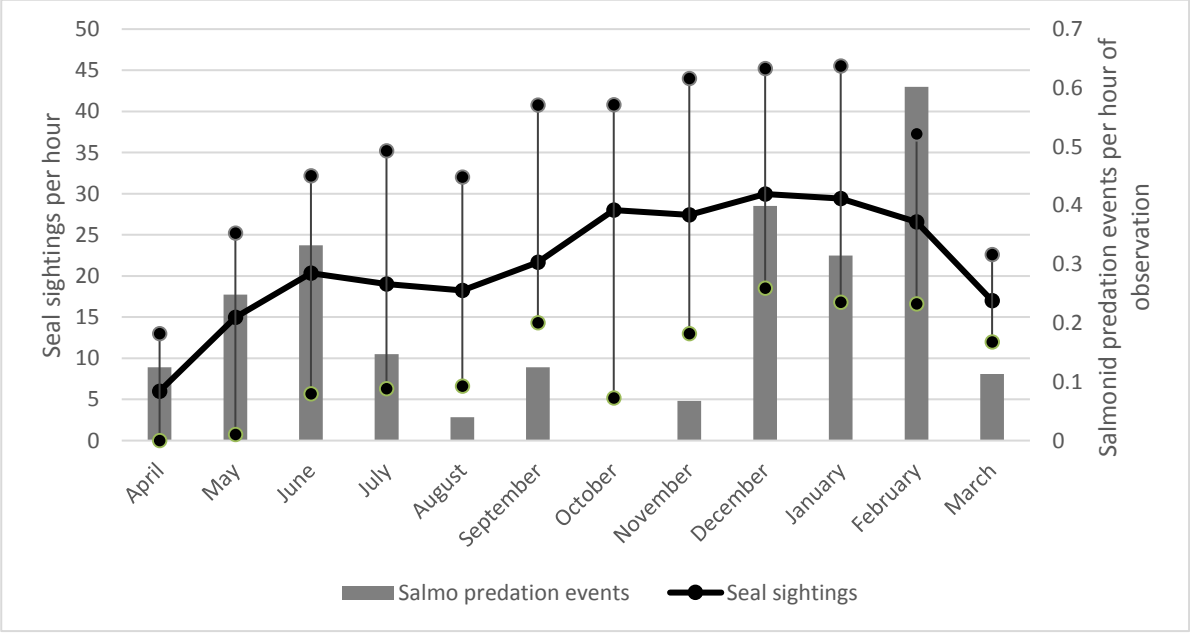

Figure 9. Average seal sightings rate for each month (black line), with range bars indicating the highest and lowest sightings rate within each month. The grey columns represent the overall sightings rate of salmonid predation events per month for the harbour.

Information on the number of individual seals, composition of seal species, specific diet information for individuals and behavioural observations will provide further insight into the interaction between seal species, their possible impacts on salmonids and the relationship with those prepared to travel higher up the river. Progress on these will be reported in spring 2018.

2.2.2 Victoria, Rail Bridge and Fisher's Bothy observation positions

Observations were also carried out from three other fixed positions within the stretch of the River Dee that is tidal. These positions allowed the majority of tidal waters to be observed (Figure 10).

Figure 10. Three maps showing the location of the observation points (in red) and the approximate area viewed by the observer (in blue) for Victoria, Rail Bridge and Fisher's Bothy. The first map (Victoria) also marks the Upper Dee Channel (UDC) zone of Aberdeen harbour.

As observations at Fisher's Bothy were prioritised, only 63 hours of observation were achieved for Victoria, with the majority of this from June to August, and only 37 hours of observations for Rail (also June to August). Observations at Fisher's Bothy amounted to 233 hours (Table 5). Coverage by observers at Fisher's Bothy allowed for a reasonable number of observation periods in most months, although little observational effort was available for May or June. No seals were seen during July at the Bothy, with the average monthly sightings rate slowly increasing each month until December when an overall rate of 2.7 seal sightings per hour were observed (Figure 11). The average sightings rate in the harbour also peaked in December.

Only two months (July and August) of comparable data were available for the three positions. At this time sightings rates at the Bothy and Rail were low, or seals were absent. At Victoria seal sightings were higher with the highest rates in June, then declining in July and August; a similar trend was also observed in the harbour (Figure 11). A single observation period was carried out from Victoria during each of May, September and January (Figure 11). No line joins the Bothy sightings rate in April to that in June, as no May observations were carried out (Figure 11). Furthermore, as no seals were observed in June or July at the Bothy no black range bars are presented for these months (Figure 11).

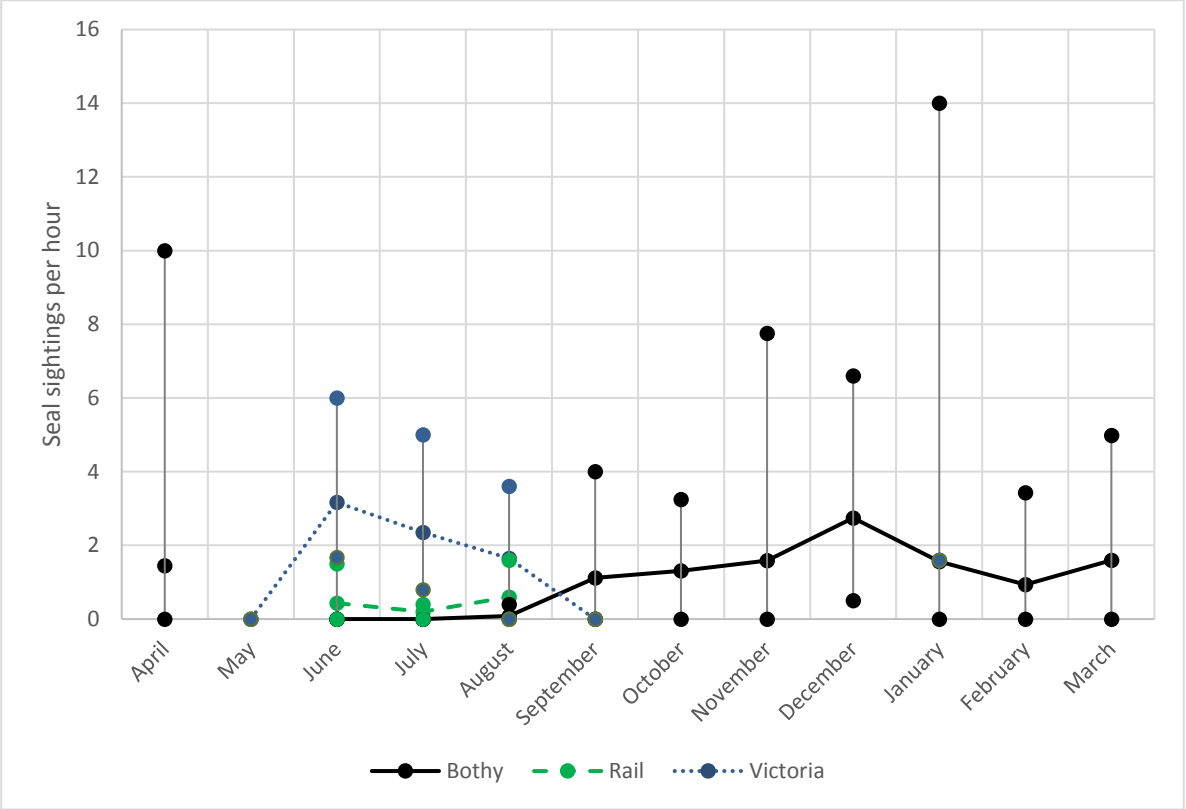

Figure 11. Average seal sightings rates by site for months where observational data was available, range bars indicate the highest and lowest sightings rate for each month (Fishers Bothy - black line; Rail Bridge - green dashed line; Victoria - blue dotted line).

2.2.3 Incidental seal reports higher up the river

An increase in the number of seal sighting reports from the DSFB above the Normal Tidal Limit (NTL) during the early part of 2017 has led to concerns from fishery staff that the problem with harbour seals above the NTL may be increasing. The increase in sightings occurred despite the installation of ADDs in the river at a site approximately 300 m below the NTL. Some of these ADDs may have been damaged or partly/completely buried following Storm Frank (December 2015) and remained in this state throughout this reporting period (April 2016 to March 2017). Incorrectly positioned or damaged units, especially with sound projectors that are buried in the river bed, are unlikely to be effective. In May 2017 the DSFB reported that the ADDs had been reinstated.

Further mitigation was undertaken by the DSFB in the spring of 2017 in the form of a canoe with an ADD slowly sweeping down the river to locate and move seals back down to the tidal limits. These canoe patrols started at 8am and ended at about 11am, and took place four days per week where possible. The patrols appeared to be successful at moving seals back down the river as seals were observed travelling downriver in front of the canoe. In some situations seals remained about 200m in front of the canoe and were not visible from the canoe (observations were made by land based observers). Improvements to how patrols are carried out should be considered. In particular, improvements in the ability of the patrol to detect seals should be made, perhaps utilising binoculars on longer sections. Furthermore, on some occasions seals were thought to have got above the canoe, possibly by making use of islands in the river. An ability to determine if this is the case should be considered.

The number of reported seal sightings above the NTL is increasingly being used by fishery managers as a measure of the extent of the River Dee 'seal problem', however, making comparisons between years is difficult due to large variations in the amount of effort and the number of observers on the river. For example, following Storm Frank (December 2015) river staff were heavily committed to restoration works during January 2016,

and only three seal sighting reports were received from above the NTL. In contrast the following year, during January 2017, river staff made a concerted effort to monitor the river for seals and eight reports were logged. Indeed, the high effort dedicated to fishery restoration throughout 2016 may be reflected in the low number of seal reports to the DSFB, as less effort was dedicated to observations of the river throughout 2016 (Table 4).

The River Dee DSFB reported seal sightings to SMRU upriver of the NTL on 26 separate days (April 2016 to March 2017). Limited photographic data were available so sightings were compiled as presence/absence data on a daily basis due to the difficulty in distinguishing between seals, and therefore the number of individual seals that may have been present each day. Fishery board staff reported that typically, where multiple sightings were reported during one day, these were thought to be a single seal moving up and down the river. However, there were a few days during the early spring (January and February 2017) when more than one seal was probably present, either because more than one seal was seen at once, or seal sightings were recorded at similar times but far apart spatially. Seal reports were from between the NTL and Banchory (between ~five and ~34 km up stream). Seal reports were primarily of harbour seals, with four exceptions when seal species was recorded as uncertain. The majority (n=19) of days with reported seal incursions above the NTL were during January and February. No DSFB seal reports were received during June, July or November. Fishery board staff managed to photograph seals above the NTL with sufficient detail on five of the 26 days. One of these five days was in April, 2016 (Table 6) when they photographed a very small harbour seal (Pv036D) that was possibly a yearling. No further images of Pv036D from above the NTL were identified and this individual was not identified at the Donmouth haulout (April 2016 to March 2017). Photographs from the remaining four days represented a juvenile female, Pv018D (n=2) or a seal that was highly likely to be Pv018D (n=2).

Fishery board staff continue to collect sightings information and seal images from seals above the NTL. Continuing to work with river staff to develop their photographic skills and knowledge of seal behaviour will increase the proportion of such images to be photo-identified.

2.2.4 Waterside Farm

An additional set of observations was made by SMRU at Waterside Farm, a location approximately one km above the NTL. The purpose was to gather additional photo-identification information to better interpret the images being collected by river staff in order to identify seals above the NTL and to quantify the number of seals that might be interfering with rod fishing further up river. Data were collected during one intensive period in March 2017.

Approximately 110 hours of observations were carried out over 15 days (minimum of four hours and a maximum of 12 hours per day). Twelve hour observation periods were made in order to investigate the time of day when seals were ascending the river.

All sightings were photo-identified. These sightings occurred on eight separate occasions and involved two different harbour seals. Interestingly, all sightings involved seals travelling down river during the morning. The juvenile female, Pv018D was seen on six days and an adult male, Pv003D was seen on two days. Pv003D, a mature adult male, blind in its left eye, was photographed eating a salmon on 8th March 2017. Pv018D, a juvenile female, was seen feeding on a small unidentified prey item on 15th March 2017.

Three visits to the Donmouth haulout were made in March 2017, with Pv018D present on each visit whilst Pv003D was present on two visits.

These additional observations demonstrated that at least two harbour seals used the River Dee above the NTL during March 2017 (Table 6), as well as the Donmouth haulout. During this time seals probably ascended the river during the night and were observed travelling downstream during the mornings. In previous years, seals have frequently been observed ascending the river during the day and it might be speculated that this diurnal behaviour pattern could have developed as a result of the regular downstream canoe/ADD sweeps during the mornings.

Table 6. Photo-identification information from images collected above the NTL by river staff and those additional SMRU observations during March 2017. The data include the first and the last time individuals were identified and the number of different years those seals were seen.

Harbour seals	Life stage	Sex	First id	Last id	Years
Pv001D	N/A	N/A	19/02/2014	19/02/2014	2014
Pv002D	adult	N/A	25/01/2015	30/01/2015	2015
Pv003D	adult	Male	26/01/2015	16/03/2017	2015, 2017
Pv018D	juvenile	Female	29/12/2016	16/03/2017	2016, 2017
Pv036D	juvenile	N/A	12/04/2016	12/04/2016	2016

Although there were occasions when both Pv003D and Pv018D remained within the tidal reaches of the Dee, they also made use of the River Don haulout after travelling down the River Dee; this haul out behaviour may allow seals to be targeted for capture. Tagging seals using the Donmouth haulout may allow a more targeted approach to mitigation (and assessing its effectiveness), while also providing a better understanding of how seals use the river. Tagging would also be important for studying any translocation of seals.

The use of acoustic tags, sonar or surveillance video to detect seals moving up-river may also provide a method for early responsive reaction by the DSFB before the seals can disrupt fishing. If several seals from the Donmouth haulout site were tagged, the data produced might form part of a responsive approach to help prevent those seals from developing river-based foraging patterns in the first place.

3. Trap

We hope to investigate potential river trap sites in 2017. Furthermore, consideration will be given to other methods for capturing seals in the river such as the use of static and active net methods.

4. Support provided to DSFBs and salmon fisheries

Support provided to wild salmon stakeholders is reported to Marine Scotland in monthly updates.

5. References

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